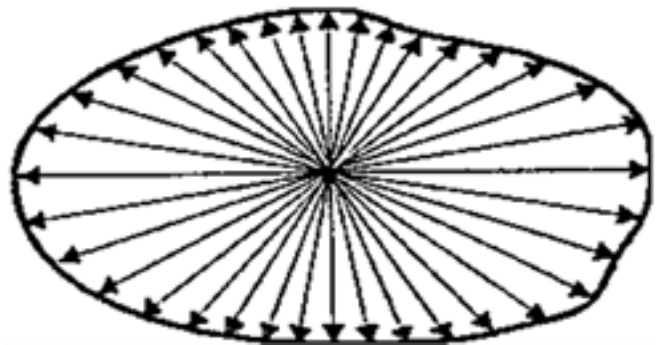
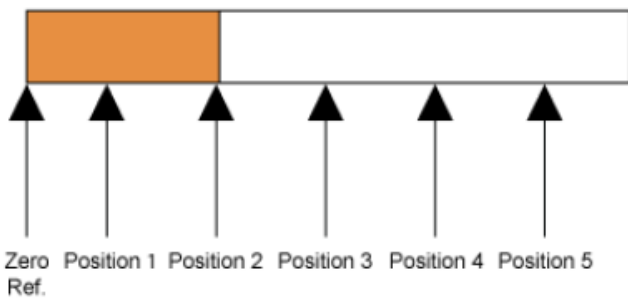


Technical Bulletin - TB2023-01

Subject: Quantum Neo S+ shelf – Upgrade considerations from the C shelf

1.0 INTRODUCTION

The Quantum Neo ‘S+’ shelf measures diameter or circumference of cigarette sticks and filters in up to five separate positions (between 5 mm and 80 mm from the rod end). Like the C shelf, it utilises a non-contact laser micrometre compliant with ISO 2971:2013. It also boasts a precision motion control system capable of 50µm positional repeatability.



The S+ can therefore report ovality, roundness and shape measurements that describe the deviation from round of any sample in up to five different positions.

The above parameters are defined as follows

$$Size = diameter = \sum_{k=1}^n \frac{d_k}{n}$$

Where d_k is the k^{th} measurement of diameter and n is the total number of measurements. A minimum of 64 measurements during a full rotation is required and the S+ takes 100 measurements per rotation.

Ovality is defined as the difference between biggest & smallest of 100 individual readings on one sample:

$$Ovality = \max diameter - \min diameter$$

Roundness is defined as:

$$Roundness = \frac{diameter - ovality}{diameter} \times 100\%$$

Shape is defined as the Coefficient of variance of 100 scans comprising a single measurement:

$$\text{Shape} = \text{CofV}\% = \frac{\text{SD}(n-1) \times 100}{\text{Mean}}$$

An accurate measurement of size is critical to the determination of ovality, roundness and shape. The following section describes how the S+ is used.

2.0 CALIBRATION OF THE OPTICAL MEASURING SYSTEM

The S+ shelf is supplied with three reference calibration standards. Two of the standards are used for the calibration of the diameter (or circumference). The third standard is used for the calibration of the positioning system on the S+ shelf.

The size standards are cylindrical metal rods with a ground surface finish of about 0.5 µm average roughness. These are supplied with a calibration certificate with reference values that are needed during the shelf calibration procedure.



Low size standard

High size standard

Issued by MPRD Ltd, trading as Cerulean			
Date of Issue	18 November 2021		
Certificate Number	63367		
Company address and performed at	Client	Page 1 of 1 Pages	
Cerulean, Rockingham Drive, Ufford Wood East, Milton Keynes MK14 6EY United Kingdom Tel: +44 (0)1908 233833 Fax: +44 (0) 1908 235333	P/E, Vitam Teknik Total Building 6th Floor Jl. Setjen, S. Parman Kav.106A Jakarta 13440 INDONESIA	Hardware Signature Name: A. Wasesit G. Williamson K. Bull Signature	
OC18a V1.3 - Circumference CM714			
Set of Two Circumference Standards			
Calibration Standard Set Serial Number: C 2711			
Ambient Conditions	21.8 °C	59.3 %RH	
	204.8	inbar	
The Test Atmosphere is controlled within the limits described in ISO 9402, Section 3.1.			
Date of Calibration: 18 November 2021			
Reported Values			
Nominal Value	Calculated Circumference (mm)	Diameter variation over 90° (mm)	Calibrated Circumference at 22 °C (mm)
16.0	15.996	0.0002	15.996
30.0	29.997	0.0000	29.997
The diameter is measured using a Leamnick Bench Micrometer, comparing directly to UKAS-certified transfer standards FI-AU (007 - 111).			
As specified in Calibration Method CM714, a Measured Diameter value is obtained by taking two sets of five individual measurements where the laser beam in an instrument intersects the standard. The standard is rotated through 90° between measurement sets. The Calculated Circumference is the mean of these 10 results multiplied by π and the Calibrated Circumference is the Calculated Circumference corrected to a temperature of 22 °C.			
This certificate relates to the standard(s) identified above and no other.			
The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95 %. The uncertainty evaluation has been carried out in accordance with UKAS requirements.			
Uncertainty = ±0.0072 mm (Circumference)			

Example calibration certificate

The length standard is rod like with a taper feature whose diameter is smaller than the large size standard. This is also supplied with a calibration certificate with reference values that are needed for the linear motion system calibration.




Length standard

OPUS METROLOGY

ISSUED BY: OPUS METROLOGY
 DATE OF ISSUE: 17th November 2020
 CERTIFICATE NUMBER: 148098

OPUS


SAFFLON ROAD,
 SAILBETWEEN INDUSTRIAL ESTATE,
 CORBY,
 NORTH HAMPTONSHIRE, NN17 4DR,
 ENGLAND
 TEL: 01535 204661
 FAX: 01535 205272
 Email: sales@opus.co.uk
 http://www.opus.co.uk



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APPROVED SIGNATURE



S. MacLeod

CUSTOMER: Hydrated Ltd,
 Milton Keynes, MK1 1UD

ORDER NUMBER: 018167

SERIAL NUMBER: 25844 **DATE OF CALIBRATION:** 17th November 2020

DESCRIPTION: Taper Assembly - LG6120

TEST CONDITIONS: Ambient Temperature 20°C ± 1°C

BASIS OF TEST: Calibrated to customer drawings LG6120 Rev. 2 and LG0580 Rev. 3

METHOD: Measurements were made using a 3 axis measuring machine.

REPORT: The results are reported in the table below.
 Identification numbers of Laboratory equipment used: A323

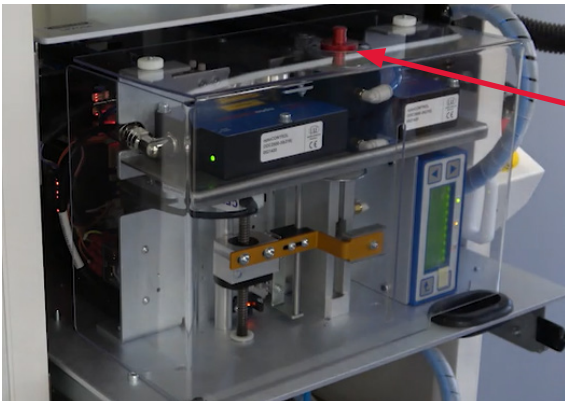
FEATURE	ACTUAL		
	POS 1	POS 2	POS 3
LENGTH FROM END FACE TO MEASURED POSITION ON DIAMETER	67.5mm	68.5mm	71.5mm
MEASURED DIAMETER AT POSITION	7.481mm	7.013mm	6.547mm
INCLUDED ANGLE BASED ON POINTS 1 & 3 (Nominal = 18.0° - (2*33.2) = 13.6°)	13.17°		
STRAIGHTNESS OF TAPER BETWEEN MEASURED POSITIONS	0.002 0mm		

UNCERTAINTY OF MEASUREMENT: ± 0.010mm On Linear Dimensions,
 ± 0.1° On Angle.

END OF DOCUMENT

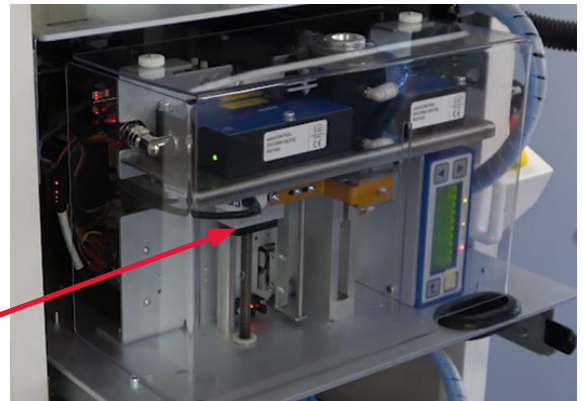
The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with ISO/IEC 17025 requirements.
 This certificate is issued in accordance with the Metrology accreditation requirements of the United Kingdom Accreditation Service.

Example calibration certificate



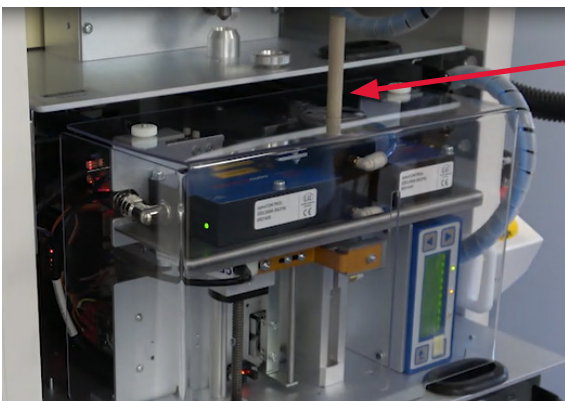
Size calibration standard in place

Figure 1 shows the shelf with the size standard in place.



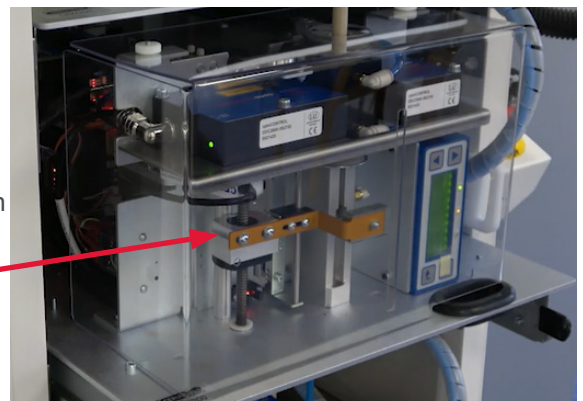
Carriage retracted to top "run position"

Figure 2 shows the shelf with the carriage at the top position ready for length calibration.



Length standard in place

Figure 3 shows the shelf with the length standard in place.



Carriage at actual "calibrated" position on the length standard.
 The tip of the arrow points to the anti-backlash mechanism.

Figure 4 shows the carriage at the actual calibration point along the taper of the length standard.

3.0 DISCUSSION

During the length calibration of the S+, the carriage moves up and down to “hunt” for the exact position on the taper. Because of the bidirectional nature of the carriage motion, Cerulean has fitted the unit with an anti-backlash mechanism in order to remove any bidirectional repeatability errors.

Figures 5 and 6 show the results of experiments whereby 10 lots of 2 different size samples were measured at 5 different measurement points to determine repeatability along a single sample. This shows that the repeatability along a single sample is better than 50 µm.

The S+ shelf is therefore a robust and reliable measuring instrument that delivers all the required measurements in line with the ISO 2971:2013 standard requirements. It also delivers up to five measurements along sample lengths, with a positional accuracy that meets current and future industry demands, making it the best choice to upgrade from the C shelf.

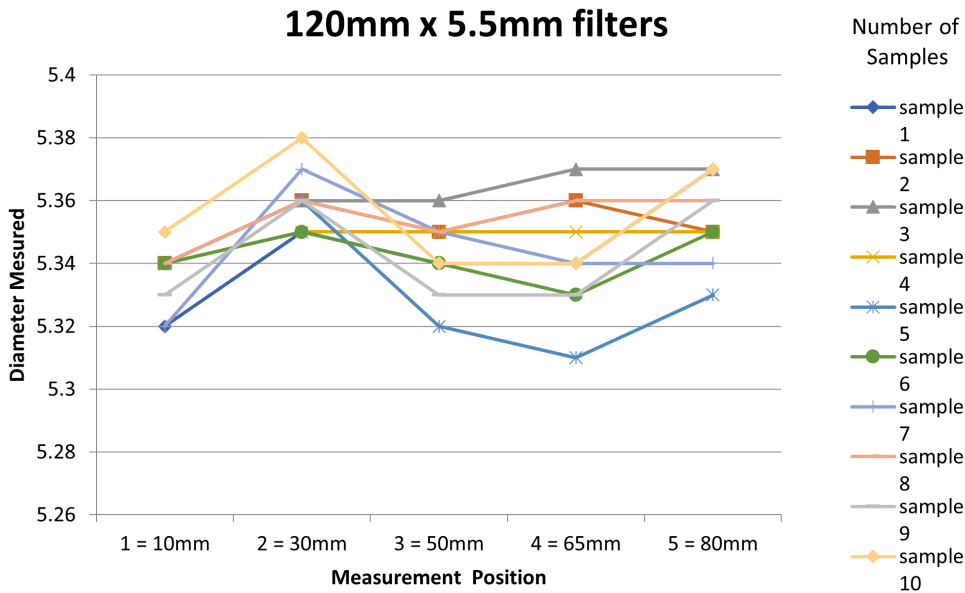


Image 5

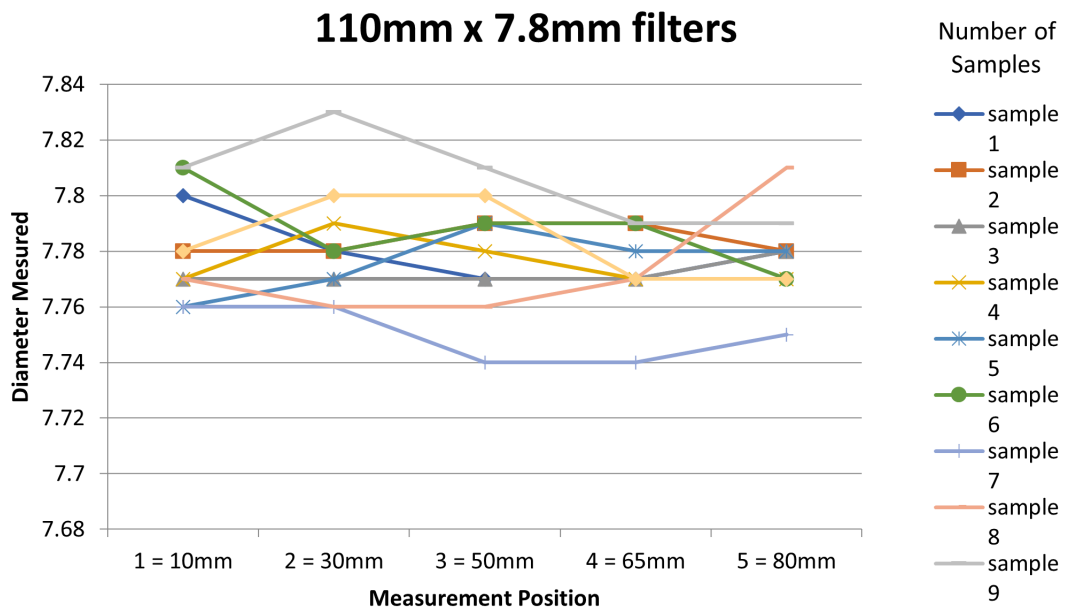


Image 6